SAFE SHUTDOWN ANALYSIS

IN

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Intermountain Power Project
Intermountain Generating Station
Safe Shutdown Analysis

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SGC
JN 25 10

Intermountain Power Project
Department of Water and Power
Room 931, General Office Building
P. O. Box 111
Los Angeles, California 90051

Attention: Mr. D. Hyska

Gentlemen:

Enclosed please find five copies of the Safe Shutdown Analysis for the following systems.

System Code	Description
COA	Coordinated Control
HRA	Condensing
HRB	Condenser Air Extraction
HRC	Circulating Water
HRD	Circulating Water Makeup
HRE	Circulating Water Chemical Feed
HRF	Condenser Cleaning
PSA	Auxiliary Steam Supply
PSB	Auxiliary Boiler Fuel
PSC	Auxiliary Boiler Chemical Feed
SGA	Steam Generator
SGC	Air Preheat

REFER
SGC
BAD 2/1/88
JDH 1/30/88
DKK FEB 4 '88 file
NAM 2/3/88
NHC 2-2-88
FILE

cc: Phil Dee
2 copies
2-9-88
DD

01.10.01

These analyses have been prepared in accordance with our Task Assignment 060487-1 and are being issued for your review. Please advise us of any comments and/or if you concur with the recommendations included in the analyses. If you have any questions, please contact Mark Harmon (913/339-7205) or Paul Spainhour (913/339-2521).

Very truly yours,

BLACK & VEATCH

Paul F. Bannister

mg
Enclosure

cc: Mr. B. E. Blowey, w/1 copy
Mr. S. G. Chapman, w/2 copies
Mr. G. T. Rose, w/2 copies

CONTROL

COA COORDINATED CONTROL
COC UNIT PROTECTION

SYSTEM: COORDINATED CONTROL (COA)
ANALYSIS: GENERAL COMMENTS

The failure of any interfacing PC may affect the operation of the Coordinated Control System. The specific interfaces and the affect of the failure will be discussed in the process related system study.

The Coordinated Control System is powered from the inverters of the Essential Service AC System. The operation of the equipment in this system will not be affected by the loss of plant auxiliary power. However, some interfacing systems are affected and may result in the Coordinated Control System responding incorrectly during the loss of power. These interfaces will be reviewed as part of the process related system study and recommendations made where necessary.

CYCLE HEAT REJECTION

HRA CONDENSING
HRB CONDENSER AIR EXTRACTION
HRC CIRCULATING WATER
HRD CIRCULATING WATER MAKEUP
HRE CIRCULATING WATER CHEMICAL FEED
HRF CONDENSER CLEANING

SYSTEM: CONDENSING (HRA)
ANALYSIS: LOSS OF PROGRAMMABLE CONTROLLER

GENERAL DESCRIPTION

The Condensate Pumps will continue to operate after the failure of an associated PC. The pump operating with the failed PC will, however, be doing so with only the motor protective relay interlocks. Although the pump can continue to operate indefinitely after a PC failure, it should be stopped as soon as possible. This can be accomplished from the Main Control Panel by placing the control switch in the stop position. In addition, the Condensate Polisher will be bypassed if the Condensate Pump 1A PC fails. If this valve is not returned to service as quickly as possible, water quality problems could arise in the plant main cycle.

RECOMMENDATIONS

It is recommended that the Condensate Polisher Bypass Valve (ACV-12) be revised to provide hardwired logic to allow a reset from the Main Control Panel after a PC failure. This revision will require the addition of three new circuits and the use of two relays in the Condensate Pump Remote I/O Cabinet.

DETAILED DESCRIPTION

The following is a detailed description of what occurs when a Condensate Pump PC fails.

I. Condensate Pump
   A. The pump will continue to operate with only the motor protective relay interlocks. The motor can be stopped from the Main Control Panel via a hardwired, control switch, stop contact. If the pump is not stopped prior to restoring the PC to operation, the pump will be tripped on the first scan of the PC logic.
   B. The pump status indication on the Main Control Panel will be lost, except the motor current indication which is hardwired.

II. Condensate Pump Discharge Valve
   A. The valve will remain in the position at the time of the PC failure. All controls will be disabled.
   B. The valve position indication on the Main Control Panel will be lost.

III. Condensate Polisher Bypass Valve (ACV-12)

A. If Condensate Pump 1A PC fails, the solenoid valve associated with this air-operated control valve will be de-energized and the Condensate Polisher Bypass Valve will be opened. This will shut down condensate flow to the Condensate Polisher. There are no hardwired backup controls for this valve.

B. Status indication and position indication on the Main Control Panel will be lost.

IV. Condensate Recirculation Valve (ACV-25)

The controls for this valve are hardwired and will not be affected by a PC failure.

V. Normal and Emergency Drawoff Valves (ACV-17 and ACV-21)

The controls for these valves are hardwired and will not be affected by a PC failure.

VI. Coordinated Control System and Information Computer

A. All Condensate Pump status points data linked to the Information Computer will be lost. This will result in the graphic displays indicating the pump as not running, the suction valve not 100 percent open, the hotwell level not adequate and the seal water pressure not adequate; regardless of the actual status.

B. The Condensate Pump Discharge Valve position will be shown as not 100 percent closed on the Information Computer graphics, regardless of the actual position.

C. Normal Drawoff Valve and Condensate Recirculation Valve positions to the Information Computer will be operational.

D. Condensate Hotwell levels to the Information Computer will be operational.

E. Condensate Hotwell temperatures to the Information Computer will be operational.

F. Condensate Drawoff flows to the Information Computer will be operational.

G. Condensate Normal Makeup flows to the Coordinated Control System will be operational.

H. Condenser shell pressures to the Information Computer and Coordinated Contorl System will be operational.

I. Condenser hood temperatures to the Information Computer will be operational.

J. Condensate Pump discharge header pressure to the Information Computer will be operational.

K. Condensate Polisher differential pressure to the Information Computer will be operational.

L. Condensate Normal Makeup Valve closed signal to the Information Computer will be operational.

VII. Alarms

A. The alarms generated by the PC will be disabled.

B. The PMCS trouble alarm for the failed Condensate Pump PC will be generated as soon as the PC fails.

SYSTEM: CONDENSING (HRA)
ANALYSIS: LOSS OF AUXILIARY POWER FOR 3 SECONDS OR LESS

GENERAL DESCRIPTION

The Condensing System will successfully "ride through" a loss of auxiliary power lasting three seconds or less. Although there are no problems associated with the loss of auxiliary power, there is one concern regarding a design feature that was added by others to assist in tripping the motor feeder breaker after a Black Trip. This addition allows the PC to trip the motor feeder breaker without the discharge valve position interlock being satisfied, if the discharge valve control power source is dead. If the direct trip is enabled during a normal shutdown of a pump, the pump could be stopped with the discharge valve open and other pumps operating. This should not result in an adverse operating condition as the discharge line is equipped with a check valve. The concern with this scheme is that the operator is not advised that the direct trip is enabled and if the controls unexpectedly respond differently, the operator's confidence in the controls may be affected.

RECOMMENDATIONS

It is recommended that an alarm or indication at the pump control station be provided to indicate that the direct trip logic is enabled.

DETAILED DESCRIPTION

The following is a detailed description of what occurs when auxiliary power is lost for three seconds or less.

I. Condensate Pump
   A. The switchgear breaker that serves the pump motor will remain closed unless a trip condition develops during the loss of auxiliary power. (Note: No trip conditions are predicted as a result of the loss of auxiliary power.) During the loss of auxiliary power, the pump motor feeder breaker will open immediately upon placing the control switch in the stop position. The discharge valve minimum flow position interlock is circumvented by the loss of control power for the discharge valve.
   B. All pump status indication on the Main Control Panel will be operational.

II. Condensate Pump Discharge Valve
   A. If traveling when power is lost, the valve will resume operation when power is restored. The direction of travel will be determined by the status of the associated pump.
   B. Position indication on the Main Control Panel will be lost as the inputs used to determine valve position are interrogated by the valve control power source.

III. Condensate Polisher Bypass Valve (ACV-12)

A. This air operated control valve will open when auxiliary power is lost and the Condensate Polisher will be bypassed by the condensate flow. If the Condensate Polisher was in service when power was lost and the permissives are still met, the solenoid valve associated with this valve will be energized when power is restored. This will allow the bypass valve to modulate condensate flow to the Condensate Polisher.

B. Position indication on the Main Control Panel will be lost. The "Reset" indicating light will remain illuminated if it was illuminated when auxiliary power was lost.

IV. Condensate Recirculation Valve (ACV-25)

A. The solenoid valve for this air operated control valve will be de-energized allowing the valve to modulate. When power is restored, the solenoid valve will assume the status called for by the logic.

B. The solenoid valve for flow controller FC-1 will be de-energized which will set the flow controller for one pump operation. When power is restored, the solenoid valve will resume the status prior to the loss of auxiliary power.

V. Normal and Emergency Drawoff Valves (ACV-17 and ACV-21)

The solenoid valves associated with these air operated control valves will be de-energized, closing both valves. When power is restored, the valves will assume the status called for by the logic.

VI. Coordinated Control System and Information Computer

A. All Condensate Pump status points in the Information Computer will be accurate.

B. The discharge valves will be shown as not fully closed on Information Computer graphics, regardless of the actual position.

C. Normal Drawoff Valve and Condensate Recirculation Valve positions on Informtion Computer graphics will be accurate.

D. Condenser Hotwell levels to the Information Computer will be functional.

E. Condenser Hotwell temperatures to the Information Computer will be functional.

F. Condensate Drawoff and Recirculation flows to the Information Computer will be functional.

G. Condensate Normal Makeup flow to the Coordinated Control System will be functional.

H. Condenser shell pressures to the Information Computer and Coordinated Control System will be functional.

I. Condenser Hood temperatures to the Information Computer will be functional.

J. Condensate Pump discharge header pressure to the Information Computer will remain functional.

K. Condensate Polisher differential pressure to the Information Computer will be functional.
L. Condensate Normal Makeup Valve closed signal to the Information Computer will be functional.

VII. Alarms
A. A travel failure alarm for the Condensate Pump Discharge Valves will be generated when power is lost.
B. The alarms for Condensate Polisher temperature high, Condensate Polisher differential pressure high and Condensate Polisher Bypass Valve not closed will be disabled.
C. The alarms for low condensate flow will be disabled.
D. The Condenser Hotwell level alarms will be functional.
E. The Gland Condenser differential pressure high alarm will be functional.
F. The Condenser Emergency Makeup Valve not closed alarm will be functional.

VII. Miscellaneous
A. The logic that indicates any Condensate Pump running to the main steam controls will be disabled.
B. The Condensate Polisher differential pressure signal to the Condensate Polisher Control Panel will be functional.

SYSTEM: CONDENSING (HRA)
ANALYSIS: LOSS OF AUXILIARY POWER FOR MORE THAN 3 SECONDS

GENERAL DESCRIPTION

The Condensing System will successfully "ride through" a Black Trip. Before power is restored, the motor feeder breakers for the Condensate Pumps should be opened. This can be accomplished by placing the control switch in the stop position.

The recommendations and detailed description for a loss of power lasting more than three seconds is as previously described in the analysis for a loss of auxiliary power lasting three seconds or less.

SYSTEM: CONDENSER AIR EXTRACTION (HRB)
ANALYSIS: LOSS OF PROGRAMMABLE CONTROLLER

GENERAL DESCRIPTION

The HRB system controls do not interface with any programmable controllers, and, therefore, will not be affected by a programmable controller failure.

SYSTEM: CONDENSER AIR EXTRACTION (HRB)
ANALYSIS: LOSS OF AUXILIARY POWER FOR 3 SECONDS OR LESS

GENERAL DESCRIPTION

If the plant auxiliary power is lost for three seconds or less, the Condenser Vacuum Pumps will stop operating. Upon restoration of power, the Condenser Vacuum Pump 1D would automatically standby start if one of the condensers vacuum was low. Operators would need to restart the other tripped vacuum pumps.

RECOMMENDATIONS

No revisions to the current design are recommended.

DETAILED DESCRIPTION

I. Condenser Vacuum Pumps 1A, 1B and 1C

The Condenser Vacuum Pumps 1A, 1B and 1C will stop running when auxiliary power is lost and will have to be restarted with their control switches when power has been restored. During the power outage, the pumps status indicating lights will go out. When power has been restored, the pumps status indicating lights will reflect that all the pumps are not running and which of the pumps have tripped. A tripped alarm for each pump that was running will appear at the plant annunciator.

All the indicating lights on the Condenser Vacuum Pumps Control Panels will go out when auxiliary power is lost.

II. Condenser Vacuum Pump 1D

This vacuum pump is used as a standby pump. If plant auxiliary power was lost, all vacuum pumps will stop operating. When power has been restored, pumps 1A, 1B and 1C will need to be restarted with the control switches. However, as soon as power has been restored, standby pump 1D will automatically start if any one of the condensers vacuum was low.

III. Seal Water Recirculation Pumps 2A, 2B, 2C and 2D

The seal water pumps will stop running upon a loss of plant auxiliary power and will not start until power has been restored and it's Condenser Vacuum Pump has been commanded to restart. There are no status indicating lights on the Main Control Panel for these pumps. The red indicating light for pump running located on the Condenser Vacuum Pump's Control Panel will go out when the pumps stop.

IV. Condenser Vacuum Breaker Valves

These valves will remain in their present position if plant auxiliary power failed. The status indicating lights on the Main Control Panel for these valves will be lost. The valves' travel failure alarms will appear at the plant annunciator two seconds after power is lost.

V. Condenser Vacuum Pump 1D Isolation Valves

These air operated valves will open because of a loss of plant auxiliary power. As soon as power has been restored, the valves will close. However, if vacuum pump 1D then automatically standby starts because vacuum on one of the condensers goes low, the isolation valve will again open to allow vacuum pump 1D to pull a vacuum on that condenser. During the power outage, the valves status indicating lights on the Main Control Panel will be lost.

VI. Seal Water Makeup Valves SBV-102, 103 and 104

Upon a loss of plant auxiliary power, these valves will close. When power has been restored, the valves will open if it's condenser vacuum seal water level is low. It will remain open for three minutes if the vacuum breaker valve associated with the condenser is closed.

SYSTEM: CONDENSER AIR EXTRACTION (HRB)
ANALYSIS: LOSS OF AUXILIARY POWER FOR MORE THAN 3 SECONDS

GENERAL DESCRIPTION

The analysis for loss of auxiliary power for more than three seconds is the same as previously listed for power loss less than three seconds.

SYSTEM: CIRCULATING WATER (HRC)
ANALYSIS: LOSS OF PROGRAMMABLE CONTROLLER (CIRCULATING WATER PUMP)

GENERAL DESCRIPTION

The failure of a Circulating Water Pump PC will result in the associated Circulating Water Pump continuing to operate, if it was operating at the time of the PC failure. It will be operating with only the motor protective relay interlocks and no process interlocks. The Circulating Water Pump can be stopped and its associated discharge valve closed from the Main Control Panel by placing the control switch in the stop position. All status indication for the pump, except motor current, will be disabled. The pump associated with the failed PC should be removed from service as soon as possible.

RECOMMENDATIONS

No revisions to the current design, except those included in Engineering Change Package No. 260, are recommended.

DETAILED DESCRIPTION
The following is a detailed description of what occurs when a Circulating Water Pump PC fails.

I. Circulating Water Pump
   A. The pump will continue to operate with only the motor protective relay interlocks. The motor can be stopped from the Main Control Panel via the hardwired, control switch, stop contact.
   B. The pump status indication on the Main Control Panel will be lost, except the motor current indication.
   C. The motor space heater will not operate when the pump is stopped.

II. Circulating Water Pump Discharge Valve
   A. The valve will remain in the position at the time of the failure. A hardwired close command will be enabled by the PC trouble relay and the command initiated when the pump control switch is placed in the stop position.
   B. The position indication on the Main Control Panel will be lost.

III. Condenser Supply Shutoff Valves (MBV-11, 12, 13 and 14)
These motor operated valves are controlled by hardwired, local selector switch stations and will not be affected by a PC failure.

IV. Condenser Discharge Shutoff Valves (MBV-7, 8, 9 and 10)
These motor operated valves are controlled by hardwired, local selector switch stations and will not be affected by a PC failure.

V. Circulating Water Pump Seal Water Supply Valves

The pump discharge seal water supply valve and the head tank seal water supply valve will both be de-energized if the PC fails. This will result in the pump discharge seal water supply valve closing and the head tank seal water supply valve opening.

VI. Circulating Water Pumps Seal Water Tank Makeup Valve (SBV-4)

This solenoid operated block valve is controlled by hardwired relay logic and will not be affected by a PC failure.

VII. Coordinated Control System and Information Computer

A. The pump running signal to the Coordinated Control System is hardwired and will not be affected by a PC failure.

B. The Circulating Water Pump suction level not low, Condenser Water Box level not low, Lockout Relay reset and Circulating Water Pump running signals to the Information Computer will be lost. This will result in the Information Computer graphics indicating the Circulating Water Pump associated with the failed PC as not running regardless of actual status. In addition, all of the start permissives for the pump will be shown as not being met regardless of their actual status. (NOTE: this is not a problem as the pump cannot be started with a failed PC.)

C. The Circulating Water Pump Discharge Valve position will be shown as not 100 percent closed on the Information Computer graphics, regardless of the actual position.

D. The signal to the Information Computer indicating that any Circulating Water Pump is running will be functional.

E. All Condenser temperature inputs to the Information Computer will be functional.

VIII. Alarms

A. The alarms for Circulating Water Pump tripped, suction level low, intake level low, intake level high and primary stop command failure are generated by the PC and will be disabled. All other alarms associated with the Circulating Water Pump will be functional.

B. The PMCS trouble alarm for the failed Circulating Water Pump PC will be generated as soon as the PC fails.

C. The alarm for the Circulating Water Pump Discharge Valve failing to reach the minimum flow position will be disabled.

D. The alarm for low level in the Circulating Water Pump Seal Water Tank will be disabled if the Unit 1 Circulating Water Pump 1C PC fails.

IX. Miscellaneous

A. The Circulating Water Pump running signal to the Water Quality Panel is hardwired and will remain operational.

B. The logic indicating that any Circulating Water Pump is running that interfaces with Water Quality Panel Panel, the Auxiliary Cooling Water Pump, the Superheater Bypass Shutoff Valve and the Main Steam Warming Line Shutoff Valve is hardwired and will not be affected by a PC failure.

C. The Circulating Water PH alarms annunciated at the Water Quality Panel will be functional.

SYSTEM: CIRCULATING WATER (HRC)
ANALYSIS: LOSS OF PROGRAMMABLE CONTROLLER (COOLING TOWER)

GENERAL DESCRIPTION

The failure of a Cooling Tower PC will not interfere with the operation of the associated cooling tower. Cooling tower fans operating at the time of the failure will continue to operate with hardwired protective interlocks that are enabled by the PC trouble relay (added by Engineering Change Package No. 278). The fans can be stopped from a local, push button, control station. When the fans are stopped after a PC failure the fan motor electric brake will immediately apply a DC voltage to the motor windings. The application of this DC voltage is normally delayed three to five seconds to allow transient voltages in the motor windings to collapse. After a PC failure, the time delay will be initiated by the loss of the "start fan" PC output. This may result in the SCR protective fuses in the brake power supply blowing. This should happen so infrequently that it does not warrant a revision to the current design.

RECOMMENDATIONS

No revisions to the current design, except those included in Engineering Change Package No. 278, are recommended.

DETAILED DESCRIPTION

The following is a detailed description of what occurs when a Cooling Tower PC fails.

I. Cooling Tower Fans
   A. The fans associated with the failed PC will continue to operate. Hardwired vibration, oil level and blade droop are enabled by the PC trouble relay and will allow safe operation of the fans after a PC failure. The fans can be individually shutdown from a local, push button, control station that is also enabled by the PC trouble relay.
   B. All status indication on the Main Control Panel will be lost. The local indication will remain in service.

II. Cooling Tower Isolation Valves (MBV-15 and 16)
These motor operated valves are controlled from hardwired, local, selector switch stations with local position indication and will not be affected by a PC failure.

III. Cooling Tower Flume Bypass Gate Operators (1A1, 1A2, 1B1, and 1B2)
   A. The gate operators will remain in the position at the time of the PC failure. All controls will be disabled.
   B. The position indication on the Main Control Panel will be lost.

IV. Cooling Tower Riser Isolation Gate Operators (1A3, 1A4, 1A5, 1A6, 1B3, 1B4, 1B5, and 1B6)

These motor operated gates are controlled from hardwired, local, selector switch stations with local position indication and will not be affected by a PC failure.

V. Cooling Tower Fan Brakes

The failure of a PC will not affect a brake that is already energized. If the fan is in operation when the PC fails, the brake energization circuit will be armed and the brake energized as soon as the fan motor feeder breaker opens. This will close the brake contactor in on the motor before any transient voltages present are allowed to collapse. If the transient voltages are greater than the voltage imposed on the motor windings by the brake, damage to the brake power supply (an SCR) or blowing of the protective fuses may occur. The actuation time of the breaker auxiliary contact that results in the energization of the brake contactor and the actuation time of the brake contactor itself may provide an adequate time delay to allow sufficient decay of motor transient voltages.

VI. Coordinated Control System and Information Computer

A. The Cooling Tower Fan vibration not high, gearbox oil level not low, bearing oil level not low and running inputs to the Information Computer will be disabled. This may result in the Information Computer graphics reflecting the incorrect status for these points.

B. The Cooling Tower Flume Bypass Gate fully closed input to the Information Computer will be disabled. This may result in the Information Computer graphics reflecting the incorrect position .

C. The Cooling Tower Riser Isolation Gate position inputs will be operational.

VII. Alarms

A. All fan related alarms will be disabled.

B. The PMCS trouble alarm for the failed Cooling Tower PC will be generated as soon as the PC fails.

VIII. Miscellaneous

The Cooling Tower permits met indicating light will be extinguished regardless of the status of the permits.

SYSTEM: CIRCULATING WATER SYSTEM (HRC)
ANALYSIS: LOSS OF AUXILIARY POWER FOR 3 SECONDS OR LESS

GENERAL DESCRIPTION

The Circulating Water System will successfully "ride through" a loss of plant auxiliary power lasting three seconds or less.

RECOMMENDATIONS

No revisions to the current design, except those included in Engineering Change Package No. 260 and Engineering Change Package No. 278, are recommended.

DETAILED DESCRIPTION

The following is a detailed description of what occurs when auxiliary power is lost for three seconds or less.

I. Circulating Water Pumps
   A. If operating when power is lost, the feeder breaker will remain closed unless a trip condition develops during the loss of power. (Note: No trip conditions are anticipated as a result of the loss of power.) The pump will resume operation when power is restored.
   B. All pump status indication on the Main Control Panel will be operational.

II. Cooling Tower Fans
   A. If operating when power is lost, the feeder breaker will remain closed unless a trip condition develops during the loss of power. (Note: The fans may trip on high vibration during coast down or when power is restored. Otherwise, no trip conditions are anticipated as a result of the loss of power.) The fans will resume operation when power is restored.
   B. All status indication on the Main Control Panel will be operational.

III. Circulating Water Pump Discharge Valves
   A. If a pump start command was in progress and the valve was opening when power was lost, the valve will continue to open when power is restored. If the pump motor feeder breaker is open or the pump control switch is in the stop or normal-after-stop position when power is restored, the valve will close.
   B. The position indicating lights on the Main Control Panel will indicate the valve is in the intermediate position, regardless of the actual position.

IV. Condenser Supply Shutoff Valves (MBV-11, 12, 13, and 14)

A. These motor operated valves are controlled by a local selector switch with maintained contacts. If operating when power is lost, these valves will resume operation when power is restored.

B. The local position indication will be lost. No Main Control Panel position indication is provided.

V. Condenser Discharge Shutoff Valves (MBV-7, 8, 9 and 10)

A. These motor operated valves are controlled by a local selector switch with maintained contacts. If operating when power is lost, these valves will resume operation when power is restored.

B. The local position indication will be lost. No Main Control Panel position indication is provided.

VI. Cooling Tower Isolation Valves (MBV-15 and 16)

A. These motor operated valves are controlled by a local selector switch with maintained contacts. If operating when power is lost, these valves will resume operation when power is restored.

B. The local position indication will be lost. No Main Control Panel position indication is provided.

VII. Cooling Tower Flume Bypass Gate Operators (1A1, 1A2, 1B1 and 1B2)

A. If operating when power is lost, the gate operators will not resume operation when power is restored.

B. Position indication on the Main Control Panel will be lost.

VIII. Cooling Tower Riser Isolation Gate Operators (1A3, 1A4, 1A5, 1A6, 1B3, 1B4, 1B5, and 1B6)

A. These motor operated gates are controlled by a local selector switch with maintained contacts. If operating when power is lost, these gates will resume operation when power is restored.

B. The local position indication will be lost. No Main Control Panel position indication is provided.

IX. Cooling Tower Fan Electric Brakes

If the fan is stopped when power is lost, the brake will be de-energized. The brake will be energized three to five seconds after power is restored. If the fan is running when power is lost and the breaker is not opened during the loss of power, the brake will not be energized when power is restored.

X. Circulating Water Pumps Seal Water Supply Valves

The logic and valves will remain operational during the loss of power as they are powered from the PC Power Distribution System.

XI. Circulating Water Pumps Seal Water Tank Supply Valve (SBV-4)

The logic and valve will remain operational during the loss of power as it is powered from the PC Power Distribution System.

XII. Coordinated Control System and Information Computer

A. The Circulating Water Pump running inputs to the Coordinated Control System will be operational.

B. The Circulating Water Pump suction level not low, Condenser Water Box level not low, Lockout Relay reset and Circulating Water Pump running inputs to the Information Computer will remain operational.

C. The Cooling Tower Fan vibration not high, gearbox oil level not low, bearing oil level not low and running inputs to the Information Computer will be operational.

D. The Condenser Supply Shutoff Valves position inputs to the Information Computer will be functional.

E. The Condenser Discharge Shutoff Valves position inputs to the Information Compuer will be functional.

F. The Cooling Tower Isolation Valves position inputs to the Information Computer will be operational.

G. The Cooling Tower Flume Bypass Gates position inputs to the Information Computer will indicate that the gates are in the fully closed position, regardless of the actual position.

H. The Information Computer input for any Circulating Water Pump running will be disabled.

I. The Circulating Water Blowdown flow signal to the Coordinated Control System will be operational.

J. The Cooling Tower water level signals to the Coordinated Control System will be operational.

K. The Circulating Water Blowdown flow control valve position signal to the Coordinated Control System and Information Computer will be functional.

L. The Cooling Tower Riser Isolation Gates position inputs to the Information Computer will be functional.

XIII. Alarms

A. All Circulating Water Pump alarms will remain functional.

B. All Cooling Tower Fan alarms will remain functional.

C. The alarms for the Circulating Water Discharge Valves not at minimum flow position will be generated when power is lost.

XIV. Miscellaneous

A. The Circulating Water Pump running input to the Water Quality Panel will be functional.

B. The logic for the Cooling Tower permits status will be functional, including the indicating lights on the Main Control Panel.

C. The logic indicating that any Circulating Water Pump is running that interfaces with the Water Quality Panel, the Auxiliary Cooling Water Pump, the Superheater Bypass Shutoff Valve, and the Main Steam Warming Line Shutoff Valve will be disabled.

D. The Circulating Water PH alarms to the Water Quality Panel will be disabled.

SYSTEM: CIRCULATING WATER SYSTEM (HRC)
ANALYSIS: LOSS OF AUXILIARY POWER FOR MORE THAN 3 SECONDS

GENERAL DESCRIPTION

The equipment in the Circulating Water System will not be adversely affected by a Black Trip. The feeder breakers for the Circulating Water Pumps will be opened by the undervoltage trip logic eight seconds after a loss of auxiliary power. The Cooling Tower Fans may trip on high vibration as they coast down; if not, the breakers can be opened via the local, stop push buttons added in Engineering Change Package No. 278. The motor operated valves in this system will remain open, which will allow the water in the system to drain to the lowest point. This will necessitate the refilling of the system prior to reestablishing Circulating Water Pump operation.

RECOMMENDATIONS

No revisions to the current design, except those included in Engineering Change Packages No. 260 and Engineering Change Package No. 278, are recommended.

DETAILED DESCRIPTION

The following is a detailed description of what occurs when auxiliary power is lost for more than three seconds.

I. Circulating Water Pumps
   A. If operating when power is lost, the feeder breaker will be tripped eight seconds after the loss of auxiliary power by the undervoltage relay trip logic. If for some reason this trip fails, the feeder breaker would be tripped by low seal water pressure or by placing the control switch in the pull to lock position. (Note: The control switch in the pull to lock position trip is delayed for two seconds to confirm that the discharge valve is not closing.)
   B. All pump status indication on the Main Control Panel will be operational.

II. Cooling Tower Fans
   A. If operating when power is lost, the feeder breaker will remain closed unless a trip condition develops during the loss of power. (Note: The fans may trip on high vibration during coast down or when power is restored. Otherwise, no trip conditions are anticipated as a result of the loss of power.) The fans will resume operation when power is restored. The fan feeder breakers can be opened from the Main Control Panel by depressing the stop push button.
   B. All status indication on the Main Control Panel will be operational.

III. Circulating Water Pump Discharge Valves

A. If a pump start command was in progress and the valve was opening when power was lost, the valve will continue to open when power is restored. If the pump motor feeder breaker is open or the pump control switch is in the stop or normal-after-stop position when power is restored, the valve will close.

B. The position indicating lights on the Main Control Panel will indicate the valve is in the intermediate position, regardless of the actual position.

IV. Condenser Supply Shutoff Valves (MBV-11, 12, 13, and 14)

A. These motor operated valves are controlled by a local selector switch with maintained contacts. If operating when power is lost, these valves will resume operation when power is restored.

B. The local position indication will be lost. No Main Control Panel position indication is provided.

V. Condenser Discharge Shutoff Valves (MBV-7, 8, 9, and 10)

A. These motor operated valves are controlled by a local selector switch with maintained contacts. If operating when power is lost, these valves will resume operation when power is restored.

B. The local position indication will be lost. No Main Control Panel position indication is provided.

VI. Cooling Tower Isolation Valves (MBV-15 and 16)

A. These motor operated valves are controlled by a local selector switch with maintained contacts. If operating when power is lost, these valves will resume operation when power is restored.

B. The local position indication will be lost. No Main Control Panel position indication is provided.

VII. Cooling Tower Flume Bypass Gate Operators (1A1, 1A2, 1B1, and 1B2)

A. If operating when power is lost, the gate operators will not resume operation when power is restored.

B. Position indication on the Main Control Panel will be lost.

VIII. Cooling Tower Riser Isolation Gate Operators (1A3, 1A4, 1A5, 1A6, 1B3, 1B4, 1B5, and 1B6)

A. These motor operated gates are controlled by a local selector switch with maintained contacts. If operating when power is lost, these gates will resume operation when power is restored.

B. The local position indication will be lost. No Main Control Panel position indication is provided.

IX. Cooling Tower Fan Electric Brakes

If the fan is stopped when power is lost, the brake will be de-energized. The brake will be energized three to five seconds after power is restored. If the fan is running when power is lost and the breaker is not opened during the loss of power, the brake will not be energized when power is restored.

X. Circulating Water Pumps Seal Water Supply Valves

The logic and valves will remain operational during the loss of power as they are powered from the PC Power Distribution System.

XI. Circulating Water Pumps Seal Water Tank Supply Valve (SBV-4)

The logic and valve will remain operational during the loss of power as it is powered from the PC Power Distribution System.

XII. Coordinated Control System and Information Computer

A. The Circulating Water Pump running inputs to the Coordinated Control System will be operational.
B. The Circulating Water Pump suction level not low, Condenser Water Box level not low, Lockout Relay reset and Circulating Water Pump running inputs to the Information Computer will remain operational.
C. The Cooling Tower Fan vibration not high, gearbox oil level not low, bearing oil level not low and running inputs to the Information Computer will be operational.
D. The Condenser Supply Shutoff Valves position inputs to the Information Computer will be functional.
E. The Condenser Discharge Shutoff Valves position inputs to the Information Computer will be functional.
F. The Cooling Tower Isolation Valves position inputs to the Information Computer will be operational.
G. The Cooling Tower Flume Bypass Gates position inputs to the Information Computer will indicate that the gates are in the fully closed position, regardless of the actual position.
H. The Information Computer input for any Circulating Water Pump running will be disabled.
I. The Circulating Water Blowdown flow signal to the Coordinated Control System will be operational.
J. The Cooling Tower water level signals to the Coordinated Control System will be operational.
K. The Circulating Water Blowdown flow control valve position signal to the Coordinated Control System and Information Computer will be functional.
L. The Cooling Tower Riser Isolation Gates position inputs to the Information Computer will be functional.

XIII. Alarms

A. All Circulating Water Pump alarms will remain functional.
B. All Cooling Tower Fan alarms will remain functional.
C. The alarms for the Circulating Water Discharge Valves not at minimum flow position will be generated when power is lost.

XIV. Miscellaneous

A. The Circulating Water Pump running input to the Water Quality Panel will be functional.

B. The logic for the Cooling Tower permits status will be functional, including the indicating lights on the Main Control Panel.

C. The logic indicating that any Circulating Water Pump is running that interfaces with the Water Quality Panel, the Auxiliary Cooling Water Pump, the Superheater Bypass Shutoff Valve and the Main Steam Warming Line Shutoff Valve will be disabled.

D. The Circulating Water PH alarms to the Water Quality Panel will be disabled.

SYSTEM: CIRCULATING WATER MAKEUP (HRD)
ANALYSIS: LOSS OF PROGRAMMABLE CONTROLLER

GENERAL DESCRIPTION

The HRD system controls do not interface with any programmable controllers, and, therefore will not be affected by a programmable controller failure.

SYSTEM: CIRCULATING WATER MAKEUP (HRD)
ANALYSIS: LOSS OF AUXILIARY POWER FOR 3 SECONDS OR LESS

GENERAL DESCRIPTION

The Circulating Water Makeup Pumps 1A, 1B and 1C will stop operating during a power outage. Alarms on the annunciator will warn the operators that the pumps header pressure has gone low. They will restart automatically and the system will successfully "ride through" a loss of auxiliary power for three seconds or less.

RECOMMENDATIONS

No revisions to the current design are recommended.

DETAILED DESCRIPTION

I. Circulating Water Makeup Pumps 1A, 1B and 1C
The Circulating Water Makeup Pumps 1A, 1B and 1C are powered from 480V SUS breakers and controlled by hardwired control switches located on the Auxiliary Control Panel. Upon a loss of plant auxiliary power, the pumps will stop operating. The breakers will not change state because they are powered from 125V DC power. Therefore, the pumps will restart when plant auxiliary power is restored. The indicating lights on the Auxiliary Control Panel will not show that the pumps have stopped operating during the power outage. An alarm for Pump Header Pressure Low may occur at the plant annunciator if the pumps stopped running long enough to not maintain adequate header pressure. The pump tripped alarms will not appear on the annunciator during the power outage.

SYSTEM: CIRCULATING WATER MAKEUP (HRD)
ANALYSIS: LOSS OF AUXILIARY POWER FOR MORE THAN 3 SECONDS

GENERAL DESCRIPTION

The Circulating Water Makeup Pumps 1A, 1B and 1C pump water from the Circulating Water Makeup Surge Tanks 1A and 1B to the Unit 1 and Unit 2 Circulating Water Intake Structures. If the system was without power for an extended time, the water level in the Circulating Water Intake Structure could be affected. The affect of low water level, however, will not affect the Circulating Water System because the units will not be operational during the power outage.

RECOMMENDATIONS

No revisions to the current design are recommended.

DETAILED DESCRIPTION

The analysis for loss of auxiliary power for more than three seconds is the same as listed for power loss less than three seconds.

SYSTEM: CIRCULATING WATER CHEMICAL FEED (HRE)
ANALYSIS: LOSS OF PROGRAMMABLE CONTROLLER

GENERAL DESCRIPTION

The Circulating Water Chemical Feed System uses a Modicon Micro 84 programmable controller for the chlorination injection portion of the Chemical Feed System. All other chemicals are introduced into the water system using hardwired controls.

RECOMMENDATIONS

No revisions to the current design are recommended.

DETAILED DESCRIPTION

I. Circulating Water Chlorine Injection Water Pump
This pump is controlled by the Modicon Micro 84 programmable controller located in the Chlorination System Control Panel 1A. If the programmable controller fails, the water pump would stop operating. The "motor tripped" alarm to the Water Quality Panel annunciator for this pump will be disabled. To restart the pump, the programmable controller would have to be repaired and the chlorination system restarted. Chlorine is added to the circulating water system once daily for approximately thirty minutes, therefore, a loss of this programmable controller for a short time (less than one day) would not adversely affect the operation of the plant.

II. Chlorination System Control Panel 1A
This panel houses the control switches, relays, timers and the programmable controller for the control of the chlorination injection system. If the programmable controller fails, the chlorination system would safely shut down. The system should be reviewed for correct operating conditions before restarting.

SYSTEM: CIRCULATING WATER CHEMICAL FEED (HRE)
ANALYSIS: LOSS OF AUXILIARY POWER FOR LESS THAN 3 SECONDS

GENERAL DESCRIPTION

The Circulating Water Chemical Feed System will successfully "ride through" a three second loss of plant auxiliary power.

RECOMMENDATIONS

No revision to the current design are recommended.

DETAILED DESCRIPTION

I. Circulating Water Inhibitor Feed Pump 2A and 2B
The Circulating Water Inhibitor Feed Pumps are controlled by START-AUTO-STOP control switches located on the Water Quality Panel. Upon a short interruption of plant auxiliary power, the pump that was running will stop operating and will have to be restarted with the control switch if a circulating water pump is running.

The status indicating lights for these pumps are located on the Water Quality Control Panel. These lights will be lost upon a plant auxiliary power outage.

The "tripped" alarms for the pumps to the Water Quality Panel will be disabled upon a loss of plant auxiliary power.

When power is lost, the level switch on the Inhibitor Day Tank will de-energize and transmitt a "low level" alarm to the annunciator on the Water Quality Panel. When power is restored, the alarm will go away.

The feed pumps stroke positioners will become de-energized and stop operating. They will resume operation when the Circulating Water Feed Pumps are started and the Coordinated Control System transmits a control signal to them.

II. Circulating Water Acid Feed Pumps 1A and 1B
The Circulating Water Acid Feed Pumps are controlled with START-AUTO-STOP control switches located on the Water Quality Control Panel. Upon a short interruption of plant auxiliary power, the pump that was running will stop operating and will have to be restarted with the control switch if a circulating water pump is running.

The status indicating lights for these pumps are located on the Water Quality Panel. Their lights will be lost upon a plant auxiliary power outage.

The motor "tripped" alarms to the annunciator on the Water Quality Panel for these pumps will be disabled.

The feed pumps stroke positioners will become de-energized and stop operating when auxiliary power has been lost. They will resume operation when the Circulating Water Acid Feed Pumps are started and the Coordinated Control System transmits a control signal to them.

III. Tolyltriazole Feed Pumps 3A and 3B

The Tolyltriazole Feed Pumps have 120V AC motors powered from local 120V AC motor starters and controlled by START-AUTO-STOP control switches located on the Water Quality Control Panel. When plant auxiliary power is lost, a pump that was running would stop and would have to be restarted with it's control switch. The status indicating lights for both pumps would be lost.

The motor "tripped" alarms to the annunciator on the Water Quality Panel for these pumps will be disabled.

When power is lost, the level switch on the tolyltriazole day tank will de-energize and transmitt a "low level" alarm to the annunciator on the Water Quality Panel.

The feed pumps stroke positioners will become de-energized and stop operating when auxiliary power has been lost. They will resume operation when the power has been restored, and the Coordinated Control System transmitts a control signal to them.

IV. Tolyltriazole Transfer Pump 2A

This pump has a 120V AC motor powered from a 120V AC local motor starter and controlled by a local START-STOP selector switch. If plant auxiliary power was lost while the pump was running, the pump would stop operating. When power was restored, the pump would automatically restart because the control switch utlizes maintained contacts. The status indicating lights on the local selector switch station would go out during the power outage.

V. Circulating Water Chlorine Injection Water Pump

The Circulating Water Chlorine Injection Water Pump is powered from a MCC motor starter and controlled by a Modicon Micro 84 programmable controller located in Chlorination Control Panel 1A. This pump provides motive water to the chlorine injector for chlorine solution preparation and injection into the circulating water system. If it was running when plant auxiliary power was lost, the pump and the controlling programmable controller would stop operating. When power has been restored, the pump would restart if the twenty-four hour timer contacts for Unit 1 or Unit 2 operation were still made up. If the pump was started manually and plant auxiliary power was lost, the pump would have to be restarted using the switch on the Chlorination System Control Panel 1A.

VI. Chlorination System Control Panel 1A

This panel is powered from breaker number 24 in 120V AC Power Panel 10. If plant auxiliary power was lost, power to this panel will be lost and "system trouble" alarm will be sent to the plant annunciator. The Modicon Micro 84 programmable controller that controls the system would lose power and stop the chlorination of the circulating water. When power is restored, the system should be checked out before restarting. The chlorine leak detector and local alarm units will be out of service during any power outage.

The air operated, electric solenoid controlled clorine injection valves (1HRE-ABV-21 and 2HRE-ABV-21) are controlled by the Micro 84 programmable controller located in this panel. If auxiliary power was lost or the programmable controller failed, these air block valves will close.

The air operated, electric solenoid control circulating water chlorine injector valves (9HRE-ABV-18 and 27) will automatically close upon a loss of plant auxiliary power or loss of the programmable controller.

SYSTEM: CIRCULATING WATER CHEMICAL FEED (HRE)
ANALYSIS: LOSS OF AUXILIARY POWER FOR MORE THAN 3 SECONDS

GENERAL DESCRIPTION

The Circulating Water Chemical Feed System will shut down upon a loss of power and will need to be reviewed before restarting.

RECOMMENDATIONS

No revisions to the current design are recommended.

DETAILED DESCRIPTION

I. Circulating Water Chlorine Injection Water Pump
This pump provides motive water to the chlorine injector for chlorine solution preparation and injection into the circulating water system. If it was running when there was a loss of plant auxiliary power which lasted for more than three seconds, at least one of the Circulating Water Pumps will have to be started before this pump could automatically restart. If the chlorine pump had been started manually, the pump would have to be restarted manually after one of the Circulating Water Pumps was started. The status indicating lights on the Chlorination Control Panel for the pump will be lost during the power outage.

II. Chlorination System Control Panel 1A
This panel controls the Circulating Water Chlorine Injection Water Pump and it's associated valves. With a loss of plant auxiliary power, the Modicon Micro 84 programmable controller, the control relays and timers located inside the panel and all status indicating lights will be disabled. When power has been restored, the system should be reviewed to ensure that all safety devices are in proper working order and twenty-four hour timers are set to the proper time of day.

III. Miscellaneous
The detailed descriptions for the analysis of the affects of a loss of auxiliary power for more than three seconds to the remainder of the Circulating Water Chemical Feed System is the same as previously listed for loss less than three seconds.

SYSTEM: CONDENSER CLEANING (HRF)
ANALYSIS: LOSS OF PROGRAMMABLE CONTROLLER

GENERAL DESCRIPTION

The Condenser Cleaning System controls do not utilize a programmable controller, therefore, will not be affected by a programmable controller failure.

SYSTEM: CONDENSER CLEANING (HRF)
ANALYSIS: LOSS OF AUXILIARY POWER FOR 3 SECONDS OR LESS

GENERAL DESCRIPTION

The Condenser Cleaning System is comprised of four condenser cleaning loops and one auxiliary cooling water heat exchanger cleaning loop. This system will successfully "ride through" a loss of plant auxiliary power for three seconds or less.

RECOMMENDATIONS

No revisions to the current design are recommended.

DETAILED DESCRIPTION

Condensing Cleaning Loops 1A through 1D and
Auxiliary Cooling Water Heat Exchanger Cleaning Collector 2

These cleaning loops are controlled and powered from individual local control panels. Upon a short loss of power, the panels will stop the cleaning process of the condensers or heat exchanger. The cleaning operation will have to be restarted because of seal in contacts wired around the pump start pushbuttons. Motorized valves for the cleaner outlets will not be affected by the loss of power. Status indication lights on the panels will be lost during the power outage.

SYSTEM: CONDENSER CLEANING (HRF)
ANALYSIS: LOSS OF AUXILIARY POWER FOR MORE THAN 3 SECONDS

GENERAL DESCRIPTION

The analysis for loss of auxiliary power for more than three seconds is the same as previously listed for power loss less than three seconds.

AUXILIARY STEAM

PSA	AUXILIARY STEAM SUPPLY
PSB	AUXILIARY BOILER FUEL
PSC	AUXILIARY BOILER CHEMICAL FEED

SYSTEM: AUXILIARY STEAM (PSA)
ANALYSIS: LOSS OF PROGRAMMABLE CONTROLLER

DETAILED DESCRIPTION

The Auxiliary Steam System does not utilize programmable controllers for the control of the system. A loss of programmable controller study is therefore not applicable.

SYSTEM: AUXILIARY STEAM (PSA)
ANALYSIS: LOSS OF AUXILIARY POWER FOR 3 SECONDS OR LESS

GENERAL DESCRIPTION

The Auxiliary Boiler 1A and 1B will trip upon a loss of plant auxiliary power. One of the requirements for operating the boilers is that there is control power at the Auxiliary Boiler Control Panel. Without power, the system is not operational and will have to be restarted.

RECOMMENDATIONS

No revisions to the current design are recommended.

DETAILED DESCRIPTION

I. Auxiliary Boiler Feed Pumps 1A and 1B
These two pumps are powered from 480V SUS breakers and controlled by control switches located on the Auxiliary Boiler Control Panel. Upon loss of plant auxiliary power, the pumps will stop operating. The status indicating lights on the Auxiliary Boiler Control Panel for the pumps will indicate that the pump is still running when actually it is not. When power has been restored, the motor will restart and the status indicating lights will be correct. No alarms will be generated at the plant annunciator or the Auxiliary Boiler annunciator.

II. Auxiliary Boiler Forced Draft Fans 1A and 1B
These two fans are powered from 480V SUS breakers and controlled by control switches located on the Auxiliary Boiler Control Panel. Upon loss of plant auxiliary power, the fans will stop operating. The status indicating lights on the Auxiliary Boiler Control Panel for the fan will indicate that the fan which has stopped is running. When power has been restored, the motor will restart and the status lights will reflect the correct status of the fans. No alarms will be generated at the plant annunciator or the Auxiliary Boiler annunciator.

III. Auxiliary Boiler Condensate Return Pumps 2A and 2B
The Auxiliary Boiler Condensate Return Pumps are powered from motor starters in 480V MCC 1A22 and 1B22. They are controlled by STOP-STANDBY-START control switches located on the Auxiliary Boiler Control Panel. Upon a loss of plant auxiliary power the pump or pumps running will stop. When the power has been restored, both pumps will automatically restart unless their control switches were in the Pull-to-Lock position. No "pump tripped" alarm will be generated unless power has been lost for more than five seconds. If a pump's switch was in the STANDBY AFTER STOP position and power was restored, the pump would start and a "standby start" alarm would be sent to the Auxiliary Boiler Control Panel. Status indicating lights will be lost during the power outage.

IV. Miscellaneous

A. Auxiliary Boiler Control Panel

This panel is fed from 120V AC Power Panel 9APA-PPL-1B22 located inside 480V MCC 1B22. Upon a loss of plant auxiliary power, the Auxiliary Boiler Control Panel will lose power except for the annunciator. Status indicating lights and control functions will be lost during the power outage. A loss of control power signal is sent to the Auxiliary Boiler 1A and 1B Burner Control Cabinets as a permissive to operate. Upon a loss of power for any amount of time, the Auxiliary Boilers 1A and 1B would stop operating. When power is restored, the boiler operation would have to be checked for proper operating conditions and restarted.

B. Auxiliary Boilers 1A and 1B Burner Control System Cabinets

These two cabinets are powered from 120V AC Power Panel 101. Upon loss of auxiliary power, a signal is sent to these cabinets from the Auxiliary Boiler Control Panel to trip the boilers. All status indicating lights on the cabinets will go out.

C. Cold Reheat Auxiliary Steam Supply Shutoff Valve MBV-17

This valve will not move when there is a loss of plant auxiliary power but a "Travel Failure Alarm" will be sent to the plant annunciator. The status indicating lights for the valve on the Auxiliary Control Panel will not be affected by the loss of power.

D. Auxiliary Steam Desuperheater Temperature Control Valve ACV-1

This valve will close and cut off the air supply to the temperature controller 1PSAT01-TC-0008. Control of the outlet steam temperature of the Auxiliary Steam Desuperheater (1PSA-DSH-1) for the pulverizer inerting steam supply will be lost during a loss of plant auxiliary power.

SYSTEM: AUXILIARY STEAM (PSA)
ANALYSIS: LOSS OF AUXILIARY POWER FOR MORE THAN 3 SECONDS

GENERAL DESCRIPTION

The analysis for loss of auxiliary power for more than three seconds is the same as previously listed for power loss of less than three seconds.

RECOMMENDATIONS

No revisions to the current design are recommended.

SYSTEM: AUXILIARY BOILER FUEL (PSB)
ANALYSIS: LOSS OF PROGRAMMABLE CONTROLLER

GENERAL DESCRIPTION

The Auxiliary Boiler Fuel System does not utilize a programmable controller, therefore a study of programmable controller failure is not applicable for this system.

SYSTEM: AUXILIARY BOILER FUEL (PSB)
ANALYSIS: LOSS OF AUXILIARY POWER FOR 3 SECONDS OR LESS

GENERAL DESCRIPTION

The Auxiliary Boiler Fuel System will successfully "ride through" a loss of plant auxiliary power for less than three seconds.

RECOMMENDATIONS

No revisions to the current design are recommended.

DETAILED DESCRIPTION

I. Auxiliary Boiler Air Compressors 1A and 1B
The Auxiliary Boiler Air Compressors 1A and 1B are powered from 480V SUS breakers and controlled by the Auxiliary Boiler Compressor Control Panels 1 and 2. Upon loss of plant auxiliary power, the compressors will stop running. A normally closed contact on the run command relays located in the control panels will close when the auxiliary power has failed and cause the tripping of the breakers. When power has been restored, the control panels will automatically restart the compressors.

II. Igniter Air Fan 1A and 1B
The Auxiliary Boiler Igniter Air Fans are powered from 480V MCC starters and controlled by local selector switches. Upon loss of plant auxiliary power, the fans will stop operating.

If the fans had been running with an automatic run command when power failed, they will restart when the air compressors restart and power is restored. If the fans had been running with a manual run command from the local selector switch when power failed, the fans would automatically restart as soon as power has been restored.

The status indicating lights on the local selector switches will be lost during the power outage and will come back on when power is restored.

SYSTEM: AUXILIARY BOILER FUEL (PSB)
ANALYSIS: LOSS OF AUXILIARY POWER FOR MORE THAN 3 SECONDS

GENERAL DESCRIPTION

The analysis for loss of auxiliary power for more than three seconds is the same as previously listed for power loss less than three seconds.

SYSTEM: AUXILIARY BOILER CHEMICAL FEED (PSC)
ANALYSIS: LOSS OF PROGRAMMABLE CONTROLLER

GENERAL DESCRIPTION

The Auxiliary Boiler Chemical Feed System does not utilize a programmable controller, therefore a study of programmable controller failure is not applicable for this system.

SYSTEM: AUXILIARY BOILER CHEMICAL FEED (PSC)
ANALYSIS: LOSS OF AUXILIARY POWER FOR 3 SECONDS OR LESS

GENERAL DESCRIPTION

The Auxiliary Boiler Chemical Feed System will not be adversely affected by a short loss of auxiliary power. Both the phosphate and the hydrazine feed pumps that were running will restart automatically when power has been restored.

RECOMMENDATIONS

No revisions to the current design are recommended.

DETAILED DESCRIPTION

I. Auxiliary Boiler Hydrazine Feed Pumps 1A and 1B
These pumps are powered by 480V MCC starters and controlled by control switches located on the Auxiliary Boiler Control Panel. In the event the two Auxiliary Boilers are operating, the two pumps will be operating; one for each boiler. If the boilers are not operating, the switches for the pumps will be in the Pull-to-Lock position and not operational. During a power failure, the status indicating lights on the Auxiliary Boiler Control Panel for the pumps will be lost. A motor tripped alarm for each pump running will be sent to the annunciator on the Auxiliary Boiler Control Panel. When power has been restored, the pumps will restart automatically and the status indicating lights will come back on.

II. Auxiliary Boiler Phosphate Feed Pumps 2A and 2B
These pumps are powered by 480V MCC starters and controlled by control switches located on the Auxiliary Boiler Control Panel. Normally only one of these pumps are operating when one or both of the Auxiliary Boilers are operating. The other pump is normally not operational because it is control switch is in the Pull-to-Lock position. Upon loss of plant auxiliary power, the pump running will stop operating. The status indicating lights on the Auxiliary Boiler Control Panel for the pumps will be lost. A motor tripped alarm will be sent to the annunciator on the Auxiliary Boiler Control Panel for the pump that tripped. When power has been restored, the pump will restart automatically and the status indicating lights for both pumps will come back on.

III. Miscellaneous
Upon a loss of plant auxiliary power, alarms will appear on the Auxiliary Boiler Control Panel annunciator for "Hydrazine Solution Tank Level Low" and "Phosphate Solution Tank Level Low".

The Hydrazine and Phosphate mixers are controlled by frame mounted ON-OFF toggle switches. If plant auxiliary power failed while these mixers were on, they would shut off. The mixers would automatically restart when power has been restored if the toggle switches were left in the ON position.

The Hydrazine Drum Pump is controlled by a wall mounted ON-OFF toggle switch. If plant auxiliary power failed while this pump was on, the pump would stop. The pump would resume operation when power has been restored if the switch was left in the ON position.

SYSTEM: AUXILIARY BOILER CHEMICAL FEED (PSC)
ANALYSIS: LOSS OF AUXILIARY POWER FOR MORE THAN 3 SECONDS

GENERAL DESCRIPTION

The analysis for loss of auxiliary power for more than three seconds is the same as previously listed for power loss less than three seconds.

STEAM GENERATION

SGA STEAM GENERATOR
SGB COMBUSTION AIR SUPPLY
SGC AIR PREHEAT
SGE IGNITER FUEL
SGF BOILER VENTS AND DRAINS
SGG MAIN STEAM
SGH BURNER AND MILLS CONTROL
SGI SOOT BLOWING
SGJ REHEAT STEAM

SYSTEM: STEAM GENERATOR (SGA)
ANALYSIS: LOSS OF PROGRAMMABLE CONTROLLERS

GENERAL DESCRIPTION

The Steam Generator System is controlled by the eight pulverizer Modicon 584 programmable controllers and by several Modicon Micro 84 programmable controllers. This analysis will be directed towards a loss of a typical pulverizer programmable controller and the Micro 84 programmable controllers.

RECOMMENDATIONS

It is recommended that alarms be developed to annunciate the loss of a Micro 84 programmable controller. To consolidate alarms on the plant annunciator, it is recommended that only one alarm per PMCS section housing Micro 84 programmable controllers be developed. This will mean an addition of six alarms per unit. This recommendation has also been suggested in the analysis for the FWB system.

DETAILED DESCRIPTION

I. Pulverizers 1A through 1H

The eight coal pulverizers are individually controlled by their own Modicon 584 programmable controllers located in Plant Motor Control System Sections 1, 2, 3, 4, 5, 6, 9 and 12. The pulverizers are powered by 6,900V Switchgear breakers and controlled with signals from the Burner Control System, the local Pulverizer Inert and Clear Panels and individual pulverizer trip push buttons on the Main Control Panel.

Upon loss of a programmable controller, the pulverizer will continue to operate. The status indicating lights for the pulverizer will be lost and an alarm will be sent to the plant annunciator warning the operators of the failed controller. All the status indicating lights on the local Pulverizer Inert and Clear Panel will be lost. The alarms to the plant annunciator for "motor overload" and "motor tripped" will be disabled. The pulverizer would be running without the "Low Lube Oil Pressure" permit and will not respond to a stop command from the local inert and clear panel. The pulverizer has been designed to have the capability of being tripped with either the individual pulverizer "Emergency Trip" push button located on the Main Control Panel or the plant's Unit Trip Relays during both normal conditions or when the programmable controller is not operating.

A pulverizer is not capable of starting when it's programmable controller is not functional.

II. Pulverizer Lube Oil Systems

The pulverizer lube oil systems are controlled by local selector switches. A loss of pulverizer programmable controllers will not affect the operation of the lube oil systems.

III. Pulverizer Water Wash Valves

These air operated, electric solenoid controlled valves are powered and controlled by the pulverizers programmable controllers. The valves will close and remain closed during a programmable controller failure. All the status indicating and procedure indicating lights on the local Pulverizer Inert and Clear Panels will be lost along with the control capability of the selector switches on the panels.

IV. Pulverizer Inerting Steam Valves

These air operated, electric solenoid controlled valves are powered and controlled by the pulverizers programmable controllers. The valves will close and remain closed during a programmable controller failure. All the status indicating and procedure indicating lights on the local Pulverizer Inert and Clear Panels will be lost along with the control capability of the selector switches on the panels.

It should be noted that when the pulverizer programmable controller is not functional, the pulverizer fire protection system is not operational.

V. Pulverizer Seal Air Dampers

These dampers are air operated and controlled with electric solenoids. The solenoids are powered and controlled by the pulverizer programmable controllers. Upon loss of programmable controller, the dampers will remain where they were.

VI. Coal Feeders

The eight coal feeders for the pulverizers are controlled by their own control cabinets and utilize signals from the Burner Control System to start and stop the feeders. Upon loss of a pulverizer programmable controller, the feeders will continue to operate until the pulverizers have been manually tripped or tripped by the Unit Protection Relays.

VII. Coal Feeder Seal Air Dampers

These dampers are air operated and controlled with electric solenoids. The solenoids are powered and controlled by the pulverizer programmable controllers. Upon loss of programmable controller, the dampers will remain where they were.

VIII. Coal Feeder Inlet Gates

These motorized gates will remain where they are if the programmable controller fails. They are controlled by CLOSE-AUTO selector switches located on the Coal Feeder Control Panels. The switches will be inoperable during a pulverizer programmable controller failure.

IX. Pulverizer Pyrites System Override

This system is used to clear a pulverizer. If the clearing process was in operation and the pulverizer programmable controller failed, the washing of the pulverizer would cease. The water wash valves would close but the pyrite gates would remain open because they are controlled by the Pulverizer Reject System (ASD) programmable controller. Upon loss of the pulverizer programmable controller, the status and operational lights on the local Pulverizer Inert and Clear Panel would be lost.

X. Superheater Desuperheat Spray Water Shutoff Valves

The Superheater Desuperheat Spray Water Shutoff Valves are controlled in pairs by Modicon Micro 84 programmable controllers located in Plant Motor Control System Section 31. They are air operated, electric solenoid controlled, powered from the programmable controller. If the programmable controller failed, the control valves will close and their status indicating lights on the Main Control Panel will go out. Signals to the Coordinated Control System for "value enabled" and alarms to the annunciator for "travel failure" will be disabled.

XI. Air Heater Soot Blowing Steam Supply Valve MBV-140,
Boiler Heater Soot Blowing Steam Supply Valve MBV-142,
Boiler Heater Soot Blowing Steam Supply Valve MBV-144,
Steam Drum Auxiliary Steam Supply Shutoff Valve MBV-2,
Secondary Superheater Outlet Auxiliary Steam Supply Valve MBV-194

The above listed valves use Modicon Micro 84 programmable controllers for the development of travel failure alarms. No other control functions are performed by the controllers. If the programmable controller failed, control of the valves would not be affected but the travel failure alarms would be disabled.

XII. Steam Drum Continuous Blowdown Valve MBV-4

This motor operated valve is controlled by a Modicon Micro 84 programmable controller located in Plant Motor Control System Section 33. Upon failure of the programmable controller, the valve will remain in the position it was in. The valve's status indicating lights on the Main Control Panel will be lost and the "valve travel failure" alarm will be disabled.

XIII. Flame Scanner Air Blowers 1A and 1B

Each of the Flame Scanner Air Blowers are powered from MCC starters and controlled by a Modicon Micro 84 programmable controller. If a blower was running with it's control switch in the STANDBY AFTER START position and the programmable controller failed, the fan would continue to run. Special provisions have been made not to stop the fans upon a controller failure. A loss of status indicating lights, "tripped" and "standby start" alarms, and the blower running status to the Information Computer will result from a programmable controller failure. The fans are capable of being started with their control switch and a disabled programmable controller.

XIV. Economizer Recirculation Valves MBV-173 and MBV-174

These two motor operated valves are controlled by individual Modicon Micro 84 programmable controllers. Upon loss of a programmable controller, the valves will remain in the position they were in. The valves status indicating lights on the Main Control Panel will be lost and the annunciator alarm for "travel failure" will be disabled. The "valve full closed" status to the Information Computer will be lost. Control of the valves with a disabled programmable controller will not be possible.

XV. Superheater Bypass Shutoff Valve MBV-135

This motor operated valve is controlled by a Modicon Micro 84 programmable controller. Upon loss of the programmable controller, the valve will remain in its position and control of the valve will not be possible. The valve's status indicating lights on the Main Control Panel will be lost and the "travel failure" alarm will be disabled. Signals to the Coordinated Control System (COA) for "valve enabled" and signals to the Information Computer for "valve full closed" and "unit load less than or equal to 50 percent" will be lost.

XVI. Reheat Steam Attemperative Block Valve MUV-133

This motor operated valve is controlled by a Modicon Micro 84 programmable controller. If the controller failed, the valve would stay in the position it was in. The valve's status indicating lights on the Main Control Panel will go out and the "travel failure" alarm to the annunciator will be disabled. The signals to the Information Computer for "valve full closed" and "unit load less than or equal to 25 percent" and the signal to the Coordinated Control System for "valve enabled" will be disabled.

SYSTEM: STEAM GENERATOR (SGA)
ANALYSIS: LOSS OF AUXILIARY POWER FOR 3 SECONDS OR LESS

GENERAL DESCRIPTION

The Steam Generator system will be tripped upon a loss of plant auxiliary power. The boiler and pulverizers will stop production of a flame in the boiler and will contribute to the tripping of the unit.

RECOMMENDATIONS

No revisions to the current design are recommended but it should be noted that control air and instrument air is required during the power outage for cooling of the Furnace Temperature Probes and the Flame Television Cameras.

DETAILED DESCRIPTION

The following is a detailed description of the affects upon the Steam Generator system when auxiliary power is lost for three seconds or less.

I. Coal Pulverizers 1A Through 1H
Upon loss of plant auxiliary power, the pulverizers will stop operating. The 6,900V breakers will not be affected by the power loss but could be tripped by a low lube oil pressure signal from the lube oil system, the plant's Unit Protection Relays, the "trip" push button on the Main Control Panel, or one of the "stop" commands from either the Pulverizer Inert and Clear Control Panel or the Burner Control System. Status indicating lights on the Main Control Panel and the Inert and Clear Control Panel will show the correct status of the pulverizer during the power outage. Alarms and signals to other systems will not be affected by a loss of plant auxiliary power.

II. Pulverizer Water Wash Valves
These valves are powered and controlled by programmable controller power which will not be affected by a loss of plant auxiliary power.

III. Pulverizer Inerting Steam Valves
These valves are powered and controlled by programmable controller power which will not be affected by a loss of plant auxiliary power.

IV. Pulverizer Seal Air Dampers
These dampers are powered and controlled by programmable controller power which will not be affected by a loss of plant auxiliary power.

V. Coal Feeders

The coal feeders will stop operating during the loss of plant auxiliary power. "Feeder discharge plugged" and "feeder not running" signals will be sent to the Burner Control System. All status indicating lights on the Coal Feeder Control Panel will be lost. Detection of coal in the silo downspout will be lost and the "feed demand" signal from the Coordinated Control System and the "feed rate" signal to the Coordinated Control System will be lost.

VI. Coal Feeder Seal Air Dampers

These dampers are powered and controlled by programmable controller power which will not be affected by a loss of plant auxiliary power.

VII. Air Heater Soot Blowing Steam Supply Valve MBV-140

This motor operated valve will stay where it is when plant auxiliary power fails. The local status indicating lights on the valve operator will be lost. The "travel failure" alarm for the valve will be disabled.

VIII. Boiler Soot Blowing Steam Supply Valve MBV-144

This motor operated valve will stay where it is when plant auxiliary power fails. The local status indicating lights on the valve operator will be lost. The "travel failure" alarm for the valve will be disabled.

IX. Steam Drum Auxiliary Steam Supply Valve MBV-2

This motorized valve will stay where it is when plant auxiliary power is lost. The indicating lights on the Main Control Panel for the valve are powered from essential service power and will not be affected by a loss of plant auxiliary power.

X. Secondary Superheater Outlet Auxiliary Steam Supply Shutoff Valve MBV-194

This motorized valve will stay where it is when plant auxiliary power is lost. The indicating lights on the Main Control Panel for the valve are powered from essential service power and will not be affected by a loss of plant auxiliary power.

XI. Steam Drum Continuous Blowdown Valve MBV-4

This motor operated valve will stay where it is when plant auxiliary power is lost. The valve's status indicating lights on the Main Control Panel will go out and the "travel failure" alarm to the annunciator will be disabled. Control of the valve will be regained when power has been restored.

XII. Secondary Air Heater Inlet Isolation Dampers
These motor operated dampers will remain where they were when power is lost. The status indicating lights on the Main Control Panel will not be affected by the power outage. The position indicator on the Main Control Panel will continue to monitor the dampers position, however, the dampers will not be operable during the power outage.

XIII. Furnace Gas Temperature Probes 1A and 1B
The probes are motor operated to extend and retract. They will remain where they are an will be inoperable during the power outage. The temperature and position indicators on the Main Control Panel will be disabled. There are no other indicating lights to tell the operator if the probes are extended into the furnace or retracted out of the furnace. Assuming the unit trips and the furnace flame will decay, there should not be a problem with the probe inserted inside the furnace. The station air supply from the plant's Compressed Air System will be needed to maintain cooling air to the probe.

XIV. Pulverizer Lube Oil Units
The pulverizer lube oil pumps will stop operating when plant auxiliary power is lost. They are controlled by local selector switches that utilize maintained switch contacts for starting the pumps. This will allow the pumps to start as soon as plant auxiliary power is restored. Status indicating lights on the local selector switch will be lost during the power outage. When lube oil pressure decays to 20 psig, the lube oil pumps will trip the pulverizer breakers.

XV. Economizer Recirculation Valve
This motor operated valve will stay in the position it was when plant auxiliary power was lost. The status indicating lights for the valve on the Main Control Panel will be lost. Control for the valve will be disabled along with the "travel failure" alarm to the annunciator. The "valve closed" signal to the Information Computer will be lost during the power outage.

XVI. Coal Feeder Inlet Gates
These motor operated gates will stay where they are in the event of a plant auxiliary power loss. The controls and status indicating lights are located on the Coal Feeder Control Cabinets which will also lose power.

XVII. Superheater Bypass Shutoff Valve MBV-135
This motor operated valve will remain in position if plant auxiliary power was lost. Status indicating lights for the valve on the Main Control Panel and the "valve enabled" signals to the Coordinated Control System will be lost. Also the "travel

failure" alarm to the annunciator will be disabled. When power has been restored, the valve will automatically close if the turbine has tripped, or all circulating water pumps are off, or a Unit Trip Relay has tripped, or if the operator pushes the CLOSE push button after power has been restored.

XVIII. Reheat Steam Attemperator Block Valve MUV-133
This motor operated valve will remain in position if plant auxiliary power was lost. Status indicating lights for the valve on the Main Control Panel will be lost. The "valve enabled" signal to the Coordinated Control System and the "valve full closed" and "unit load less than 25 percent" signals to the Information Computer will be lost. The "valve travel failure" alarm to the plant annunciator will become disabled. When plant auxiliary power is restored, the valve will automatically close if one of the following conditions are present: Either Unit Trip Relays tripped, turbine tripped, the load is greater than 25 percent or if the operator pushes the CLOSE push button.

XIX. Reheat Flue Gas Biasing Dampers
These motorized dampers are controlled by the Coordinated Control System. They will be inoperable during a loss of plant auxiliary power. When power has been restored, the Coordinated Control System will be able to adjust the position of the dampers.

XX. Secondary Superheater Outlet Auxiliary Steam Supply Valve MBV-194
This motorized valve will stay where it is when plant auxiliary power is lost. The indicating lights are powered from essential service power and will not affected by a loss of plant auxiliary power.

XXI. Combustion Gas Reheat Soot Blowing Steam Supply Valve MBV-24
This valve is motor operated and controlled by the Combustion Gas Reheat Coil Control Cabinet. It will stay in the position it was in when the plant power fails. A valve travel failure alarm will appear at the annunciator when power fails.

XXII. Superheat DC Block Valve MBV-171
This valve will not be affected by a loss of plant auxiliary power. The DC motor is supplied by the plant battery system and the controls and indication are powered by the plant essential service power system.

XXIII. Superheater Desuperheater Spray Water Valves
These valves are controlled by Modicon Micro 84 programmable controllers and powered from the plant essential service power supply. These valves control and status indicating lights will not be affected by a loss of plant auxiliary power. It should be noted, however, that air is required to operate these valves and the plant control air system should be regained as soon as possible on loss of power.

XXIV. Furnace Flame Cameras

The furnace flame cameras are powered from 120V AC power panels fed from the plant auxiliary power system. The cameras will lose power and will remain in the position they were at when powered failed. The pictures on the monitors in the Main Control Panel will be lost. When power is lost, the solenoid valves for the cooling air supply to the camera and lens will open, allowing cooling to the equipment for as long as there is a supply of air.

XXV. Seal Air Fan Discharge Dampers

The Seal Air Fan Discharge Dampers are solenoid controlled air operated dampers which will stay where they are when power fails.

XXVI. Seal Air Fans

The Seal Air Fans are powered from 480V SUS breakers and controlled by control switches on the Main Control Panel. When power fails, the fans will stop and when power is restored, the fans will restart because the 125V DC controlled SUS breakers will stay in the closed position throughout the power outage. An alarm at the plant annunciator will also be sounded for low air pressure.

XXVII. Primary Air Heater Gas Inlet Dampers

These dampers have 90V DC motors which are powered and controlled from the Miscellaneous Control Drives Cabinet. These dampers will stay where they were when power was lost.

XXVIII. Pulverizer CO Monitoring

The Pulverizer CO Monitoring Control Cabinets will stop the monitoring of pulverizer CO during a power outage. An alarm will be sent to the plant annunciator for power failure.

XXIX. Economizer Flue Gas Analyzers

The Economizer Flue Gas Analyzers are powered from normal plant auxiliary power. The analyzers will stop sampling and analyzing the economizer flue gas during a power outage.

SYSTEM: STEAM GENERATOR (SGA)
ANALYSIS: LOSS OF AUXILIARY POWER FOR MORE THAN 3 SECONDS

GENERAL DESCRIPTION

The analysis for loss of plant auxiliary power for more than three seconds is the same as previously listed for power loss less than three seconds.

RECOMMENDATIONS

No revisions to the current design are recommended but it should be noted that control air and instrument air is required during the outage for cooling the Furnace Temperature Probes and Flame Television Cameras.

SYSTEM: AIR PREHEAT (SGC)
ANALYSIS: LOSS OF PROGRAMMABLE CONTROLLER

GENERAL DESCRIPTION

The Air Preheat System includes two Air Preheat Water Pumps which are controlled by Plant Motor Control System Sections 8 and 40. Loss of one programmable controller will not affect the standby operation of the other pump. The remainder of the systems equipment is hardwired and will not be affected by a loss of any programmable controller.

RECOMMENDATIONS

No revisions to the current design are recommended.

DETAILED DESCRIPTION

I. Air Preheat Water Pumps 1A and 1B

Air Preheat Water Pump 1A is controlled by Plant Motor Control System Section 8 and Air Preheat Water Pump 1B is controlled by Plant Motor Control System Section 40. Air Preheat Water Pump 1B is controlled by the same programmable controller as the Turbine Seals and Drains System. If one of these programmable controllers failed, there would be an alarm sent to the plant annunciator to warn the operators. If one of the pump's programmable controller failed while the pump was running, the pump would stop operating. If the other pump's control switch was in the STANDBY position, that pump would automatically start. The status indicating lights for the pump with the defective programmable controller will go out and the "pump tripped" alarm will not be sent to the plant annunciator. When the standby pump automatically starts, a "standby start" alarm will be sent to the plant annunciator and it's status indicating lights will reflect the pump running.

If Air Preheat Water Pump 1A programmable controller (PMCS Section 8) failed, the following alarms will be disabled: Air Preheat Water Pump 1A Standby Start, Air Preheat Water Pump 1A Tripped, Air Preheat Water Pump Discharge Flow Low and Air Preheat Water Pump D/P Low.

If Air Preheat Water Pump 1B programmable controller (PMCS Section 40) failed, the following alarms for the Air Preheat System will be disabled: Air Preheat Water Pump 1B Standby Start and Air Preheat Water Pump 1B Tripped. Along with the loss of control of Air Preheat Water Pump 1B, a loss of the programmable controller in Plant Motor Control System Section 40 will also affect the Turbine Seals and Drains System (TGC).

II. Air Preheat Emergency Drain to Condenser Block Valve MBV-139
This DC powered valve is controlled by Plant Motor Control System Section 8. If this programmable controller failed, the valve will be inoperable and stay where it is. There would be an alarm to the plant annunciator warning the operators of the programmable controller failure and the valve's status indicating lights will be lost.

SYSTEM: AIR PREHEAT (SGC)
ANALYSIS: LOSS OF AUXILIARY POWER FOR 3 SECONDS OR LESS

GENERAL DESCRIPTION

The SGC system will successfully "ride through" a loss of auxiliary power lasting three seconds or less.

RECOMMENDATIONS

No revisions to the current design are recommended.

DETAILED DESCRIPTION

The following is a detailed description of the affects upon the Air Preheat System when auxiliary power is lost for three seconds or less.

I. Air Preheat Water Pumps 1A and 1B
Upon loss of plant auxiliary power, the Air Preheat Water Pump that is operating will stop running. The pumps status indicating lights on the Main Control Panel will stay on and will reflect the correct status of both pumps. A pump tripped signal will not be generated in the programmable controller because power to the input card which is needed for the signal will be lost. Therefore, the white tripped light on the Main Control Panel and the tripped alarm on the plant annunicator will not be generated.

II. Air Preheat Water Flow Shutoff Valves MBV-132 and 133
The two motorized Air Preheat Water Flow Shutoff Valves will stay in the position they were in when plant auxiliary power is lost. If the valve was traveling open or closed when plant auxiliary power was lost, the valve would stop and a travel failure alarm would appear at the plant annunciator. The valves position indicating lights on the Main Control Panel will go out until power is restored.

III. Air Preheat Emergency Drain to Condenser Block Valve MBV-139
This DC motor operated valve will not be affected by a plant auxiliary power loss. The motor is operated from a reliable DC source, the inputs and outputs are all 120V AC from a PC Distribution Power Panel which has an inverter backup, and the valves indicating lights on the Main Control Panel are powered from the Main Control Panel power supply which is backed up by the plant inverter system.

IV. Air Preheat Return Water Diverting Valve ACV-134
The Air Preheat Return Water Diverting Valve ACV-134 will de-energize and divert water to the deaerator when plant auxiliary power is lost.

V. Air Preheat Emergency Drain to Condenser Control Valve ACV-138
This valve is an electric solenoid controlled air operated valve which is controlled by Plant Motor Control System Section 8. If plant auxiliary power were lost for three seconds or less, there would be no affects upon the valve.

SYSTEM: AIR PREHEAT (SGC)
ANALYSIS: LOSS OF AUXILIARY POWER FOR MORE THAN 3 SECONDS

GENERAL DESCRIPTION

The Air Preheat System would stop operating during a loss of plant auxiliary power. The Air Preheat Water Pumps would stop operating and the motorized operated valves would remain where they were when power was lost. The emergency drain valve MBV-139 is a DC powered, programmable controller controlled valve which would not be affected by a loss of plant auxiliary power. The analysis for loss of auxiliary power for more than three seconds is the same as previously listed for power loss less than three seconds.

RECOMMENDATIONS

No revisions to the current design are recommended.